Mr. Michael T. Davis Pre-Calculus	3.4 Logarithms – Expanding and Condensing (1) February 23, 2016

Name: Solutions

I. $\log_b x + \log_b y = \log_b (xy)$

The sum of two logs is the one log of the product of the logarands

II. $\log_b m - \log_b n = \log_b \left(\frac{m}{n}\right)$

The difference of two logs is the one log of the difference of the logarands

III. $\log_b \left(w^p\right) = p \log_b w$

The log of a base with a power is the product of the power and the log

Use the properties of logarithms to EXPAND the following expressions (do not evaluate):

1. $\log_b (6 \cdot 11) =$ $\log_b 6 + \log_b 11$	2. $\log_b \left(\frac{6}{11}\right) =$ $\log_b 6 - \log_b 11$
3. $\log_4 \left(3^5\right) =$ $5 \log_4 3$	4. $\log_5 \left(x^3 \cdot y\right) =$ $\log_5 x^3 + \log_5 y$ $= 3 \log_5 x + \log_5 y$
5. $\log\left(\frac{m}{n^2}\right) =$ $\log m - \log n^2$ $= \log m - 2 \log n$	6. $\log\left(a \cdot c^4\right) =$ $\log a + \log c^4$ $= \log a + 4 \log c$
7. $\log(a \cdot c)^4 =$ $4 \log (a \cdot c)$ $= 4 \log a + 4 \log c$	8. $\log_5 \left(x \cdot y \cdot z^2\right) =$ $\log_5 x + \log_5 y + \log_5 z^2$ $= \log_5 x + \log_5 y + 2 \log_5 z$
9. $\log_3 \sqrt{x \cdot y} =$ $\log_3 (x \cdot y)^{\frac{1}{2}}$ $= \frac{1}{2} \log_3 (xy)$ $= \frac{1}{2} \log_3 x + \frac{1}{2} \log_3 y$	10. $\log\left(\frac{m}{kc}\right) =$ $\log m - \log (kc)$ $= \log m - (\log k + \log c)$ $= \log m - \log k - \log c$

11. $\log\left(\frac{kc}{m}\right) =$ $\log(kc) - \log m$ $= \log k + \log c - \log m$	12. $\log\left(m^2\sqrt{n}\right) =$ $\log m^2 + \log \sqrt{n}$ $= 2\log m + \frac{1}{2}\log n$

Use the properties of logarithms to CONDENSE the following expressions (do not evaluate):

1. $\log 3 + \log 8 =$ $\log 24$	2. $\log_b 3 - \log_b 8 =$ $\log_b\left(\frac{3}{8}\right)$
3. $\frac{1}{2}\log 36 =$ $\log 36^{\frac{1}{2}} = \log \sqrt{36}$ $= \log 6$	4. $\frac{\log 27}{3} =$ $\frac{1}{3}\log 27 = \log 27^{\frac{1}{3}}$ $= \log 3$
5. $2\log_b 3 + 3\log_b 2 =$ $\log_b 3^2 + \log_b 2^3$ $= \log_b 9 + \log_b 8 = \log_b 72$	6. $2\log_5 3 - 3\log_5 2 =$ $\log_5 3^2 - \log_5 2^3$ $= \log_5 9 - \log_5 8 = \log_5\left(\frac{9}{8}\right)$
7. $4\log_3 x + 4\log_3 y =$ $\log_3 x^4 + \log_3 y^4$ $= \log_3(x^4y^4) = \log_3(xy)^4$	8. $4\log_3 x - 4\log_3 y =$ $\log_3 x^4 - \log_3 y^4$ $= \log_3\left(\frac{x^4}{y^4}\right) = \log_3\left(\frac{x}{y}\right)^4$
9. $\log A + \log B + \log C =$ $\log(ABC)$	10. $\log A + \log B - \log C =$ $\log(AB) - \log C$ $= \log\left(\frac{AB}{C}\right)$
11. $\frac{2}{3}\log_b 8 + 3\log_b 2 =$ $= \log_b 8^{2/3} + \log_b 2^3 = \log_b 4 + \log_b 8$ $= \log_b 32$	12. $3(\log 8 - \log 4) - (\log 3 + 2\log 5) =$ $3\log\left(\frac{8}{4}\right) - (\log 3 + \log 5^2)$ $3\log 2 - (\log 3 + \log 25)$ $\log 2^3 - \log 25$ $\log 8 - \log 75$ $\log\left(\frac{8}{75}\right)$